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## A comparison of catches of fishes and invertebrates by two light trap designs, in tropical NW Australia

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**Abstract** Light traps were deployed in two sampling programs. In the first, small and large traps were released to drift with the current at stations along a cross-shelf transect on the NW Shelf off the coast of Western Australia. In the second program, pairs of small and large traps were deployed on moorings 150 m off the coastline. The composition and size-frequency distributions of catches of fishes in small and large traps were similar for both modes of deployment. In drifting traps, nearly 78% of this catch was composed of reef fishes, and these were collected in significantly greater numbers by the small design than by large traps (9.51 vs. 5.84 individuals  $\text{h}^{-1}$ , respectively). Nine taxa (amphipods, mysids, crab megalopae, copepods, cumaceans, isopods, caridean shrimps, polychaetes and the euphausiid, *Pseudeuphausia latifrons*) accounted for 99% of the total catch of invertebrates by drifting traps. Of these, catches of amphipods, copepods, cumaceans and *P. latifrons* were greater in large traps than in small traps (3,134 vs. 1,687  $\text{h}^{-1}$ , 1,018 vs. 214  $\text{h}^{-1}$ , 551 vs. 165  $\text{h}^{-1}$  and 74 vs. 9 individuals  $\text{h}^{-1}$ , respectively). In contrast, crab megalopae were more abundant in catches by small traps than by large traps (3,134 vs. 1,687 individuals  $\text{h}^{-1}$ , respectively). The catch rate of fishes in moored traps

was higher than in drifting traps (105 vs. 20 fishes  $\text{h}^{-1}$ ) and was dominated by baitfishes (86% of total catch). Reef fishes were also captured in greater numbers by small traps than by the large design (10.17 vs. 4.4 individuals  $\text{h}^{-1}$ ) in this mode of deployment. Despite these differences in catch rates, multivariate analysis showed that cross-shelf patterns in catches of fishes and invertebrates were mapped equally well by both trap designs. Variation in the efficiency of trap designs thus appears to be small when compared to changes in the composition and abundance of zooplankton assemblages that occur at scales of tens of kilometers.

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### Introduction

Light traps (Doherty 1987) are often used in marine ecosystems to attract and capture mobile invertebrates and the older nektonic stages of reef fishes that are competent or near-competent to settle into adult habitats. Due to their agility, such taxa are not well sampled by methods such as towed nets (Choat et al. 1993; Hickford and Schiel 1999). Since their initial use in coastal waters in the late 1980s, light traps have become a popular sampling technique, particularly in tropical environments where some important questions focus on the life history stages of reef fishes that are preferentially targeted by this method (Wolanski et al. 1997).

Despite the increasing variety of light trap designs now in use by researchers, only one study has compared the sampling performance of different traps. Hernandez and Lindquist (1999) used large and small traps to sample larval fishes over an offshore reef on the coast of North Carolina, USA. They found that the different trap designs collected equivalent components of the assemblage of reef fishes, but that the large trap tended to catch slightly higher numbers of fishes than the small design. While this outcome was consistent with expectations, as small traps emit less light and have a higher potential for escapement than large traps,

a lack of similar studies impedes the ability of researchers to draw general conclusions from the numerous databases that have now been generated by light trap techniques.

Here, we compare the abundance and composition of catches of fishes and invertebrates in large and small light traps on the NW shelf of Australia. The trap designs examined in this work have been used in long-term (multi-year) sampling programs in the Caribbean (Hendricks et al. 2001; Wilson, 2001) and on the Great Barrier Reef (Carleton et al., 2001). Ultimately, the aim of our study is to facilitate comparisons among these and other ongoing light trap studies on the NW Shelf. In previous sampling programs, light traps have been deployed on moorings in the nearshore waters around reefs (e.g. Milicich and Doherty 1994; Sponaugle and Cowen 1996; Reyns and Sponaugle 1999), or allowed to drift with a water mass (e.g. Thorrold and Williams 1996; Hernandez and Lindquist 1999). Concurrent sampling has shown that rates of capture and catch compositions may differ between drifting and moored traps (Thorrold 1992), and, for this reason, small and large traps were compared in both modes of deployment. In order to compare trap performance under a wide range of conditions, we sampled at monthly intervals over an entire summer, during which time drifting traps were deployed in habitats ranging from nearshore environments to oceanic waters at the edge of the continental shelf. Our

sampling programs examined: (1) differences in the taxonomic composition and abundance of fishes and invertebrates collected by small and large traps; (2) differences in the size composition of catches of fishes between trap types; (3) the relative abilities of small and large traps to map spatial distributions of fishes and invertebrates.

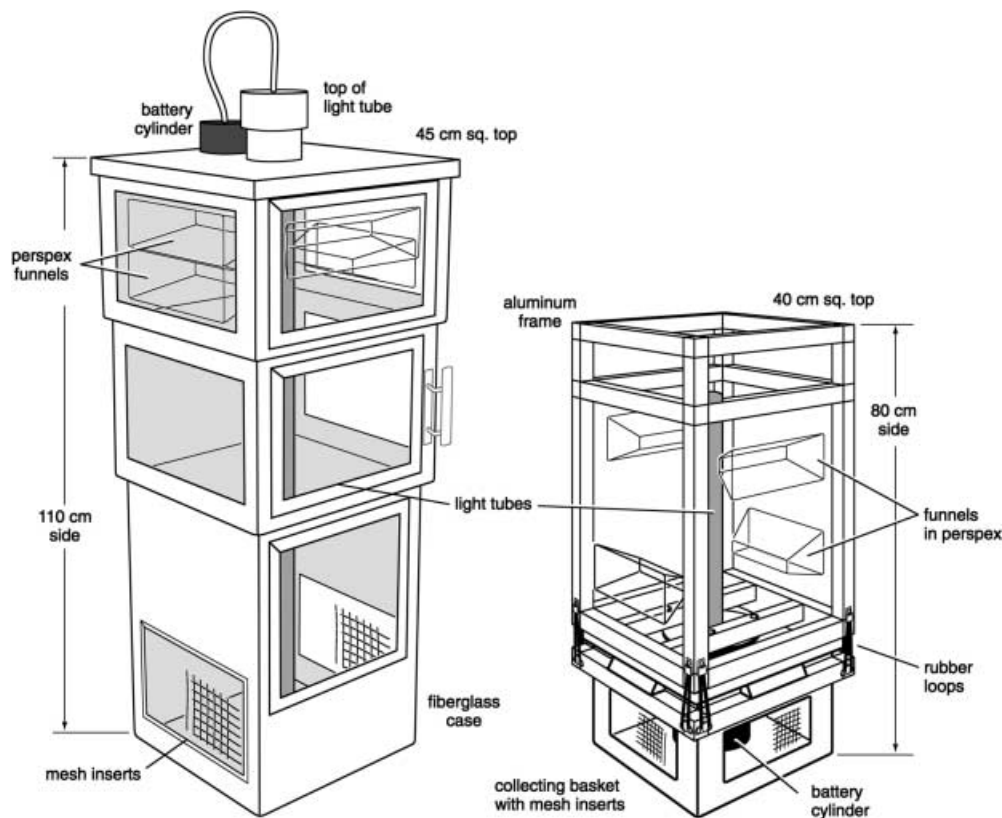
## Materials and methods

### Light trap designs

Both large and small traps were variations on the design of Doherty (1987) (Fig. 1). The large trap consisted of a rectangular fiberglass body internally subdivided into three chambers connected by tapered slits. The upper two chambers had panels of clear Plexiglas on three sides, while the lower chamber had only one clear panel. A Plexiglas tube containing the lights ran through the center of the trap so that each chamber contained a single white fluorescent light. A second cylinder containing batteries and a timer was housed in the uppermost chamber. Six horizontally tapered slits in the upper chamber allowed entry for photopositive organisms. Lights in the chambers flashed in sequence to draw these organisms into the trap and down to the bottom chamber.

The small trap consisted of a single chamber made of Plexiglas in an aluminum frame. In the center of this chamber a tube of Plexiglas housed a single white fluorescent light that operated continuously when the trap was fishing. Photopositive organisms entered through four horizontal, tapered slits in the Perspex. A plastic bucket with mesh inserts was attached to the bottom of the chamber. These inserts allowed water to drain when the trap was retrieved so that captured organisms accumulated in the bucket.

**Fig. 1** Designs of large and small light traps



## Sampling design

### Drifting traps

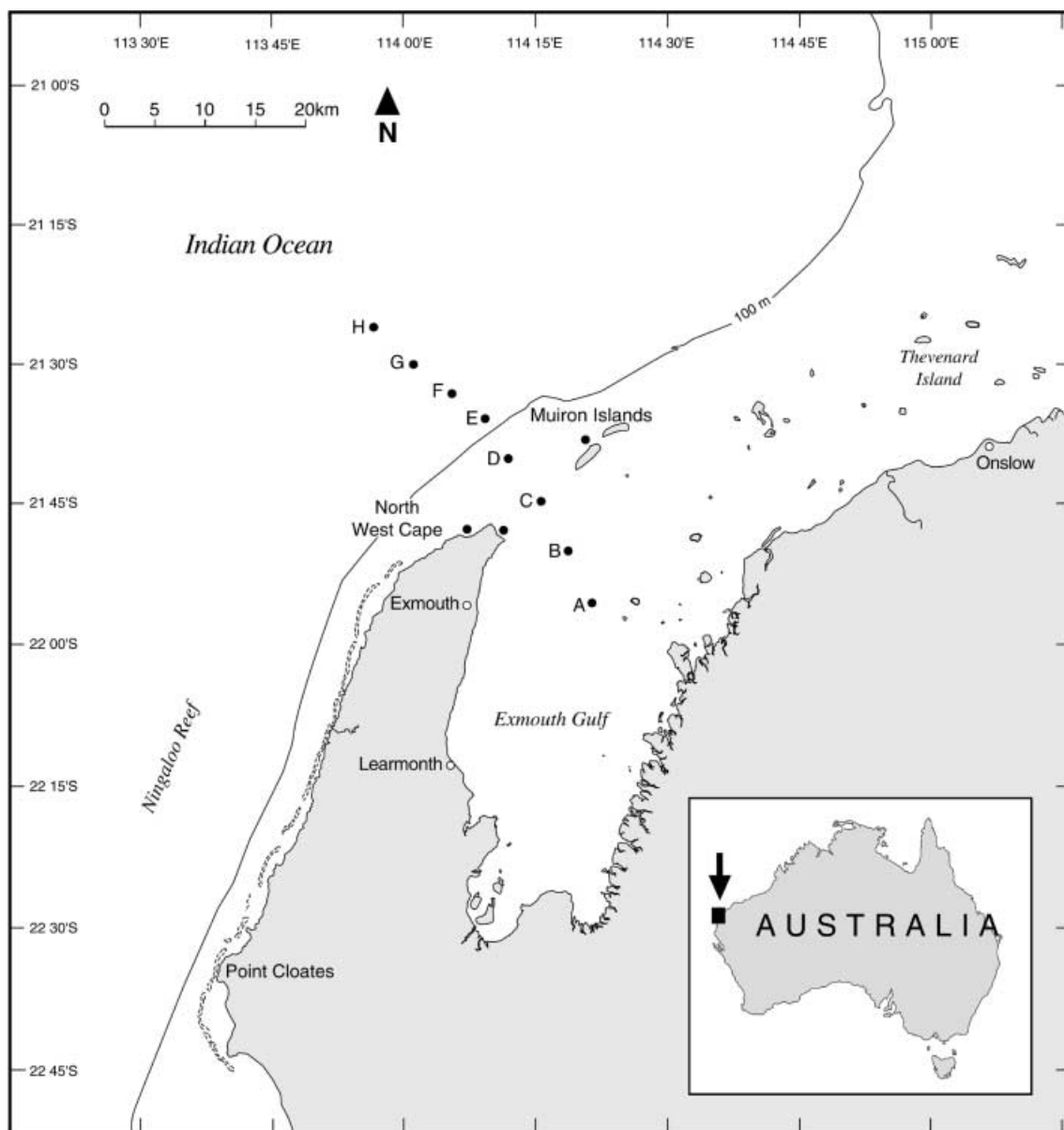
The two trap designs were sampled concurrently during five cruises of 10 days duration, centered around successive new moons from October 1997 until March 1998 on the NW Shelf, Western Australia. Traps were deployed at eight stations on a transect from the shore across the continental shelf (Fig. 2A–H). At each station, two large and two small traps were released to float at the surface. Each trap was attached to a buoy so that it hung vertically in the water column with the entrance slits approximately 1 m below the surface. The traps were allowed to drift freely with the current for an hour, after which time they were retrieved and the catches emptied. A total of 71 stations were sampled during the summer, giving a

total of 66 paired deployments of small and large traps. At the end of fishing, catches were immediately preserved in alcohol. In the laboratory, collections were sorted, identified and the standard lengths of fishes measured. Abundant catches of invertebrates (i.e. >2,000 individuals) were sub-sampled using a Folsom plankton splitter to obtain a fraction of 1/2–1/64th of the sample. Prior to splitting, large and rare fauna were removed, identified and enumerated.

### Moored traps

Small and large traps were moored in pairs at the Murion Islands and at North West Cape (Fig. 2). This sampling program operated only during the last three of the five cruises and deployed a total of 21 pairs of small and large traps over 17 nights of fishing. Traps were moored close (150 m) to the reef in approximately 20 m of water. Buoys floated the traps vertically in the water column with the entrance slits at 1 m depth. Small and large traps in each pair were separated by 100 m to avoid any overlap of the areas illuminated by the light. Traps fished throughout the night, and water movement through the mesh sides of the traps allowed fishes and

**Fig. 2** Location of sampling stations (A–H) on a transect across the Exmouth Gulf and NW Shelf of northern Western Australia. Sites at the Murion Islands and North West Cape where traps were moored are also shown



invertebrates to remain alive until they were removed the following morning. Due to the logistics involved in sorting invertebrate collections, only catches of fishes were identified and measured. When catches were large, sub-samples of a minimum of 50 fish of each species were measured.

#### Data analysis

Catches of fishes and invertebrates were identified to family. For analysis, fishes were pooled into three broad categories: baitfishes, reef fishes and other. The composition of each of these groups is

shown in Table 1. Abundances of fishes and invertebrates obtained from drifting traps were standardized to numbers per hour of sampling and analyzed using a two-factor ANOVA, where the factors were trap design (small and large) and cruise. Cochran's *C* and plots of residuals were used to examine the assumptions of normality and homoscedasticity of datasets prior to analysis. In order to conform with these assumptions, datasets of invertebrates were transformed to  $\log_{10}$  values. As baitfishes were only abundant in drifting traps during one cruise, datasets for these fishes were pooled among cruises and compared between trap designs using a *t*-test. Catches of fishes in small and large moored traps were analyzed in the same manner. Size-frequency distributions of each

**Table 1** Mean catch ( $\text{h}^{-1}$ , standard deviation in *parentheses*) and percentage composition of families of fishes collected by small and large light traps deployed in drifting and moored modes (*UID* unidentified)

Family	Drifting traps				Moored traps			
	Small		Large		Small		Large	
	Mean (SD)	%	Mean (SD)	%	Mean (SD)	%	Mean (SD)	%
Reef fish								
Pomacentridae	4.53 (6.82)	39.22	2.40 (4.33)	30.54	7.26 (11.18)	14.62	2.70 (6.90)	4.86
Lethrinidae	1.28 (4.79)	11.08	0.42 (1.34)	5.45	0.05 (0.11)	0.09		
Blenniidae	0.99 (4.77)	8.60	2.01 (12.19)	25.50	1.69 (2.12)	3.40	0.51 (0.55)	0.92
Mullidae	0.90 (2.08)	7.81	0.12 (0.46)	1.49	0.01 (0.04)	0.03	0.05 (0.10)	0.08
Priacanthidae	0.46 (3.43)	3.94	0.25 (1.54)	3.16			0.02 (0.09)	0.04
Synodontidae	0.43 (2.47)	3.71	0.05 (0.36)	0.66	0.02 (0.06)	0.04	0.01 (0.04)	0.02
Siganidae	0.32 (1.14)	2.74	0.22 (1.35)	2.83	0.05 (0.10)	0.09	0.01 (0.06)	0.02
Holocentridae	0.11 (0.63)	0.99	0.04 (0.21)	0.47	0.01 (0.03)	0.01	0.01 (0.03)	0.01
Apogonidae	0.10 (0.47)	0.90	0.04 (0.23)	0.45	0.64 (0.91)	1.30	0.13 (0.23)	0.23
Monacanthidae	0.08 (0.38)	0.70	0.10 (0.47)	1.21	0.11 (0.11)	0.21	0.12 (0.27)	0.21
Ostraciidae	0.08 (0.27)	0.69	0.07 (0.34)	0.86			0.01 (0.03)	0.01
Chaetodontidae	0.05 (0.27)	0.46	0.03 (0.17)	0.41	0.07 (0.14)	0.13	0.01 (0.04)	0.02
Dactylopteridae	0.05 (0.26)	0.45	0.02 (0.19)	0.30				
Labridae	0.03 (0.24)	0.25	0.01 (0.08)	0.09				
Pseudochromidae	0.02 (0.17)	0.17		0.00	0.11 (0.35)	0.23	0.20 (0.44)	0.36
Tripterygiidae	0.02 (0.17)	0.17		0.00	0.17 (0.27)	0.34	0.02 (0.05)	0.04
Sphyrnidae	0.01 (0.09)	0.09		0.00				
Serranidae	0.01 (0.09)	0.06	0.05 (0.41)	0.61	0.01 (0.03)	0.01		
Uranoscopidae	0.01 (0.09)	0.06	0.01 (0.10)	0.16				
Diodontidae	0.01 (0.08)	0.06		0.00	0.01 (0.03)	0.01	0.01 (0.03)	0.01
Gobiidae	0.01 (0.08)	0.06		0.00	0.02 (0.06)	0.04	0.01 (0.04)	0.02
Scorpaenidae	0.01 (0.07)	0.05		0.00				
Scatophagidae			0.01 (0.07)	0.07				
Pomacanthidae					0.01 (0.04)	0.03		
Acanthuridae					0.01 (0.03)	0.01	0.02 (0.05)	0.04
Balistidae							0.01 (0.03)	0.01
Batrachoididae							0.01 (0.03)	0.01
Leptocephaloidae							0.01 (0.03)	0.01
Pempheridae							0.01 (0.03)	0.01
Syngnathidae							0.01 (0.03)	0.01
Tetrapontidae							0.01 (0.03)	0.01
Group total (%)		82.27		74.25		20.61		6.96
Baitfishes								
Atherinidae	0.19 (1.00)	1.62	0.02 (0.15)	0.23	2.88 (6.56)	5.79	0.23 (0.57)	0.41
Clupeidae	0.15 (0.48)	1.27	0.54 (3.55)	6.87	36.46 (54.18)	73.41	51.14 (108.79)	92.05
Engraulidae	0.03 (0.17)	0.24	0.30 (1.28)	3.76	0.01 (0.03)	0.01	0.01 (0.04)	0.02
Group total (%)		3.14		10.85		79.22		92.49
Others								
Scombridae	0.42 (1.92)	3.66	0.43 (2.01)	5.43			0.03 (0.11)	0.05
Carangidae	0.37 (1.03)	3.19	0.28 (1.42)	3.59	0.05 (0.10)	0.09	0.17 (0.50)	0.31
Bregmacerotidae	0.35 (2.70)	3.03	0.15 (0.99)	1.88	0.01 (0.03)	0.01	0.11 (0.23)	0.19
Myctophidae	0.22 (1.28)	1.92	0.06 (0.38)	0.77				
UID	0.15 (0.77)	1.30	0.25 (0.97)	3.14	0.03 (0.07)	0.05		
Hemiramphidae	0.11 (0.68)	0.93		0.00				
Exocoetidae	0.06 (0.34)	0.50		0.00				
Fistulariidae	0.01 (0.07)	0.05	0.01 (0.08)	0.09				
Soleidae					0.01 (0.03)	0.01		
Group total (%)		14.59		14.90		0.17		0.54

family of fishes collected by small and large traps were compared using Kolmogorov–Smirnov tests for datasets from drifting and moored deployments.

Spatial patterns in catches of fishes and invertebrates along the cross-shelf transect were examined using a hierarchical clustering analysis. Datasets were pooled among cruises, and the Bray–Curtis measure (Bray and Curtis 1957) was used to calculate the level of dissimilarity among samples. Ward's sums of squares strategy was used to fuse samples into groups to produce a dendrogram.

## Results

### Drifting traps

These traps collected 31 families of reef-associated fishes, 3 families of baitfishes and 8 families of other (non-reef) fishes. Reef species accounted for the majority (78%) of the 3,398 fishes collected by the traps, while baitfishes and non-reef species comprised 7% and 15% of this catch, respectively. Pomacentrids were the most abundant family of fishes collected by both small and large trap designs (Table 1). Eight families of fishes (six reef and two non-reef) were collected exclusively by small light traps, and one family of reef fishes was collected only by large traps. All of these families occurred in very low numbers and were represented by totals of fewer than ten individuals in catches.

ANOVAs detected significant differences in total catches of fishes between trap designs. On average, catches in small traps were slightly, but significantly greater than those in large traps ( $df=1,4$ ,  $F=15.47$ ,  $P=0.017$ ; Fig. 3). This was largely due to differences in catches of reef fishes ( $df=1,4$ ,  $F=14.17$ ,  $P=0.02$ ; Fig. 3). Abundances of non-reef and baitfishes did not differ between designs, although average catches of these taxa were relatively low ( $df=1,4$ ,  $F=0.052$ ,  $P=0.831$ ; Fig. 3). There were no significant differences in the size frequency distributions of the ten most abundant families of fishes collected by the small and large light traps (Kolmogorov–Smirnov tests,  $P>0.05$ ).

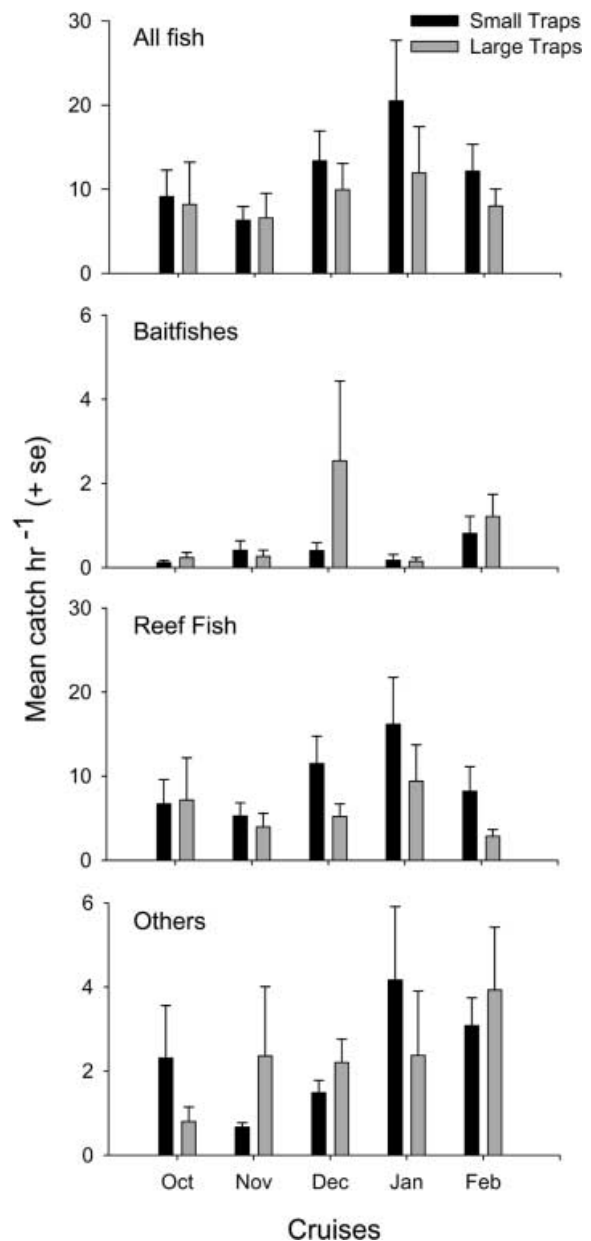
Catches in both small and large designs were numerically dominated by amphipods (Table 2). Large traps collected greater total numbers of invertebrates (two-factor ANOVA,  $df=1,4$ ,  $F=8.04$ ,  $P=0.047$ ) and significantly greater abundances of amphipods ( $df=1,4$ ,  $F=9.28$ ,  $P=0.038$ ), copepods ( $df=1,4$ ,  $F=15.55$ ,  $P=0.017$ ), cumaceans ( $df=1,4$ ,  $F=23.16$ ,  $P=0.009$ ) and the euphausiid *Pseudeuphausia latifrons* ( $df=1,4$ ,  $F=75.82$ ,  $P=0.001$ ) than small traps (Fig. 4). In contrast, small traps recorded higher catches of crab megalopae than large traps ( $df=1,4$ ,  $F=17.59$ ,  $P=0.014$ ). Catches of mysids, isopods, caridean shrimps and polychaetes did not differ between designs (two-factor ANOVAs,  $P>0.05$ ; Fig. 4).

Bray–Curtis classification analyses of datasets of fishes and invertebrates from drifting traps did not identify any consistent differences that could be attributed to trap design. In both analyses, the first divisions of the dendrograms split catches made at inshore sta-

tions from those at mid-shelf and offshore stations (Fig. 5). Catches in small and large traps at the same station usually clustered together, implying that differences in catch composition and abundance among stations were typically far greater than those between trap types.

### Moored traps

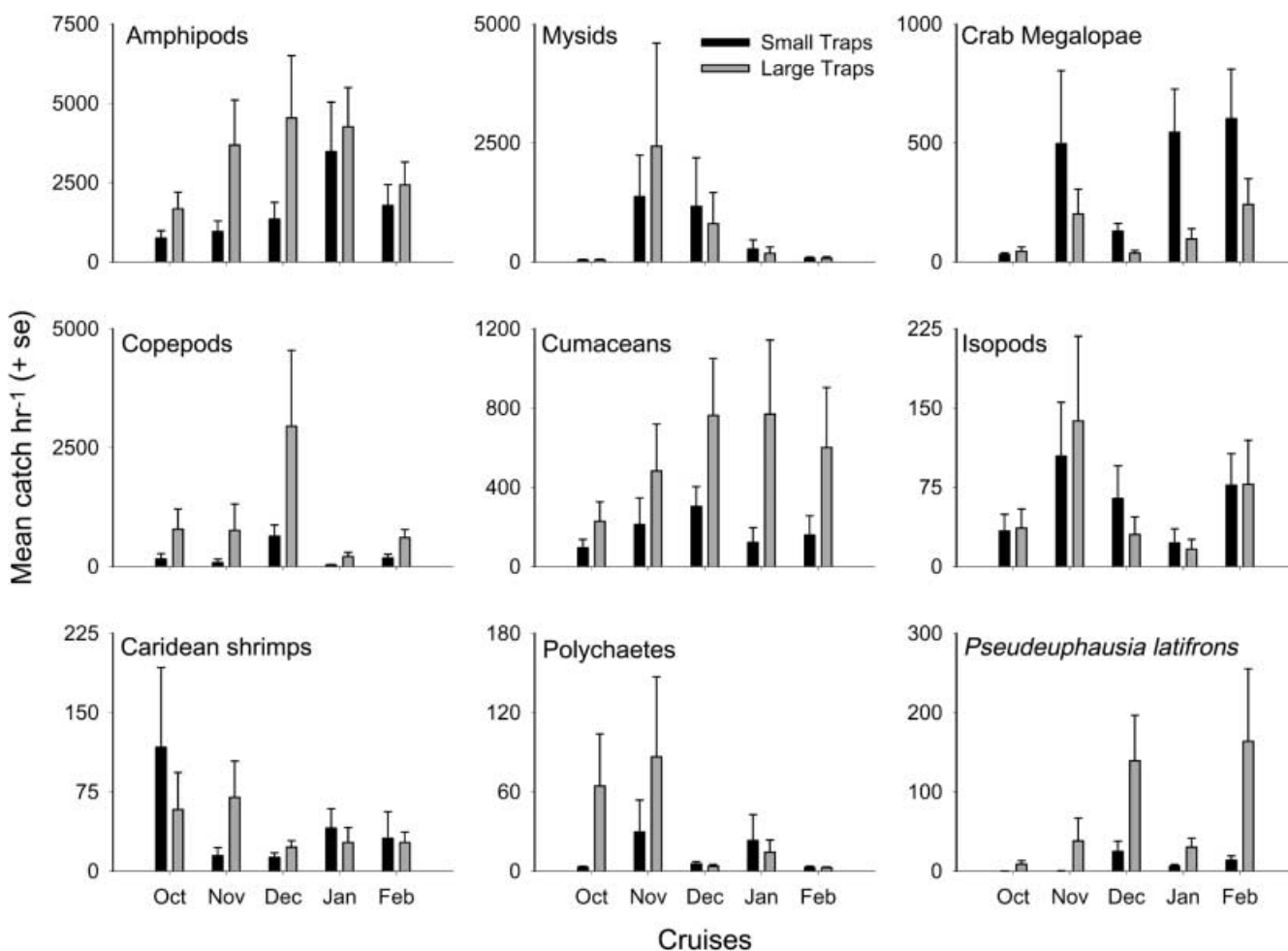
The average catch rate of fishes in moored traps was more than four times that of drifting traps ( $105$  vs.  $20$  fishes  $h^{-1}$ , respectively), primarily due to an increase



**Fig. 3** Mean catch ( $h^{-1}$ ) of all fish, baitfishes, reef fishes and “other” (non-reef) fishes by drifting light traps during five cruises on the NW Shelf, Western Australia

**Table 2** Mean catch ( $\text{h}^{-1}$ , standard deviation in parentheses) and percentage of catch composition of invertebrate taxa collected by small and large drifting light traps

	Small			Large		
	Mean	(SD)	%	Mean	(SD)	%
Amphipods	1,687.57	(3,180.75)	56.34	3,134.56	(4,226.06)	56.28
Mysids	444.65	(1,746.63)	14.85	473.26	(2,139.50)	8.50
Crab megalopae	332.47	(586.31)	11.10	112.95	(234.57)	2.03
Copepods	213.95	(493.48)	7.14	1,018.34	(2,702.92)	18.29
Cumaceans	164.49	(301.14)	5.49	550.78	(979.38)	9.89
Isopods	53.71	(93.09)	1.79	50.70	(113.67)	0.91
Carideans	51.76	(178.26)	1.73	39.38	(89.01)	0.71
Polychaetes	10.50	(40.03)	0.35	31.39	(105.63)	0.56
<i>Pseudeuphausia latifrons</i>	8.80	(23.00)	0.29	73.88	(189.46)	1.33

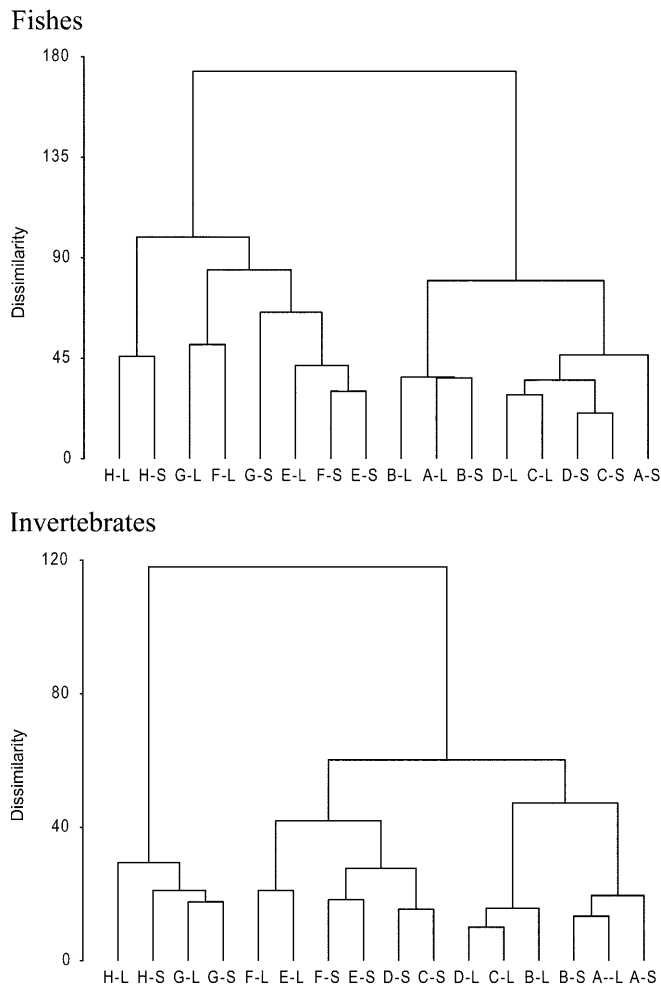


**Fig. 4** Mean catch ( $\text{h}^{-1}$ ) of invertebrate taxa collected by drifting light traps during five cruises on the NW Shelf, Western Australia

in numbers of baitfishes. While these were captured at a rate of 1.2 individuals  $\text{h}^{-1}$  in drifting traps,  $>90$  individuals  $\text{h}^{-1}$  were collected in moored traps. A total of 15,993 fishes were captured by moored traps, of which 86% were baitfishes, 14% reef fishes and  $<1\%$  other (non-reef) fishes (Table 1). Eight families of fishes (five reef and two non-reef) were only collected by small light traps, while nine families (eight reef and one non-reef)

were collected exclusively in large traps. Virtually all of these families occurred in very low numbers in catches ( $<10$  individuals).

Pomacentrids were the most abundant family of reef fishes collected by both traps. While there was no consistent difference in total catches between large and small traps when deployed on moorings ( $t$ -test,  $t = -0.135$ ,  $df = 1,20$ ,  $P = 0.894$ ; Fig. 6), small traps collected greater numbers of reef fishes ( $t$ -test,  $t = 3.246$ ,  $df = 1,20$ ,  $P < 0.01$ ). There were no significant differences in catches of baitfishes or non-reef families ( $t$ -tests,  $t = -0.588$ ,

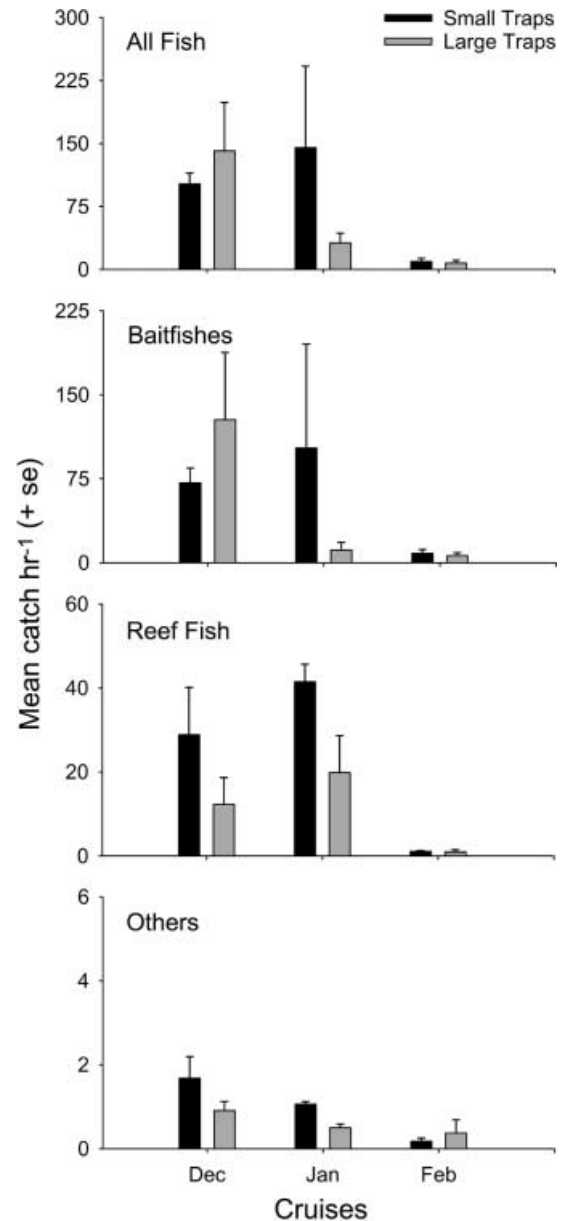


**Fig. 5** Dendrograms generated by Bray-Curtis analysis of fishes and invertebrates captured by small and large traps at stations on a transect across the NW Shelf, Western Australia. For this analysis, samples were pooled among cruises (A–H correspond to station locations shown in Fig. 2; L large trap; S small trap)

$df=1,20$ ,  $P=0.563$  and  $t=1.157$ ,  $df=1,20$ ,  $P=0.261$ , respectively) or in the size-frequency distributions of the ten most-abundant families of fishes between trap types (Kolmogorov–Smirnov tests,  $P>0.05$ ).

## Discussion

Given the reduced complexity, size and light output of the small trap, we predicted that it would not capture and retain fishes and invertebrates as effectively as the large design. However, our study shows that this was not necessarily the case. While both traps caught equivalent components of the zooplankton assemblage, small traps collected greater numbers of reef fishes than large traps in both drifting and moored deployments. Underwater observations of the behavior of fishes and invertebrates around light traps suggest why this might occur. Once attracted to the light, pre-settlement reef fishes such as pomacentrids appear to find trap entrances by chance,



**Fig. 6** Mean catch ( $h^{-1}$ ) of all fish, baitfishes, reef fishes and “other” fishes by moored light traps at the Murion Islands and North West Cape, Western Australia

often only after a long period of haphazard searching on the clear panels (P.J. Doherty, unpublished data). This implies that the probability of encounter with entrances is an important determinant of the capture efficiency of these taxa (Meekan et al. 2000). Although both trap designs had entrances of a similar number and size, the large traps had two additional chambers that emitted light, but did not allow entry. These chambers may disperse reef fishes around the trap and away from entrances, reducing their chances of capture.

While this may also account for the differences in catches of crab megalopae between trap designs, the pattern of greater catches in small traps was not consistent among all taxa of invertebrates, many of which

were caught in higher numbers by the large traps. Unlike reef fishes and crab megalopae, which are collected as late stage larvae or pre-settlement juveniles, most invertebrates are collected as adults and are extremely active around the light (Meekan et al. 2000). Such behavior may increase their chances of encountering the entrances of large traps, although it is likely that differences in catch rates of these taxa are also strongly influenced by escapement. Once inside, invertebrates tend to circle the tube housing the light, while reef fishes descend to the bottom of the trap and crab megalopae cling to trap surfaces (authors', personal observations, P.J. Doherty, unpublished data). When small traps are lifted from the water, invertebrates near the light may drain out lower entrances. As a result, most invertebrates have a higher rate of escapement than reef fishes in small traps (Meekan et al. 2000). Loss of invertebrates during trap retrieval is less of a problem in the large design, since catches are distributed among three chambers, only one of which has external entrances that are located on the uppermost part of the top chamber.

Baitfishes behave in a similar manner to invertebrates in the vicinity of light traps (P.J. Doherty, unpublished data) and, as a result, are also more prone to escapement from small traps than reef fishes (Meekan et al. 2000). While it might be expected that baitfishes should therefore be collected in greater numbers by large traps, we were unable to detect any consistent differences in catches of these taxa between trap designs. These results are not surprising for drifting traps, where abundances of these taxa averaged  $< 1$  individual  $\text{h}^{-1}$  and our statistical tests had limited power to discern differences. However, in moored traps, baitfishes dominated catches and were often collected at rates of  $> 100$  fish  $\text{h}^{-1}$ . In this deployment mode, the lack of differences in catch rates between trap designs may reflect our sampling technique. Unlike drifting traps that were retrieved after an hour of fishing, moored traps fished throughout the night, and catches were only removed in the morning. By this time, most baitfishes either resided near the bottom of the trap, or had died after continually swimming into the trap walls. Consequently, escapement was low when traps were emptied.

The composition of catches of fishes recorded by our study were typical of those of light trap sampling programs in northern Australia and two localities in the Caribbean (Great Barrier Reef – Choat et al. 1993; Milicich and Doherty 1994; Doherty and Carleton 1997; Barbados – Sponaugle and Cowen 1996; Caribbean Panama – Hendricks et al. 2001). In these studies, baitfishes and pomacentrids have also dominated collections, with other reef families such as blenniids and apogonids also forming significant parts of catches. While this implies that our findings may be broadly applicable to other localities, our results contrast with those of Hernandez and Lindquist (1999), who found that a large trap based on the design of Doherty (1987) collected slightly greater abundances of fishes than small

traps of the design of Brogan (1994). To compare designs, Hernandez and Lindquist (1999) deployed light traps in deep water (28 m) over an offshore reef on the temperate coast of North Carolina, USA. During their 2 week study, they collected only 330 fishes at an average rate of just over 1 fish  $\text{h}^{-1}$  of sampling. Less than a third of these were the reef-associated species that are the primary targets of most light trap studies. Additionally, nearly a quarter of the catch of fishes were young pre-flexion or flexion stages. In contrast, during the present study, catch rates sometimes exceeded hundreds of fish per hour and were dominated by fishes at or very near the end of the larval stage, a pattern that is typical of most light trap sampling programs (e.g. Choat et al. 1993; Brogan 1994; Hickford and Schiel 1999). Thus, the identity of catches and the timing and location of sampling in Hernandez and Lindquist's (1999) study may account for their apparently contradictory results.

Despite differences in the capture efficiency of some fishes and invertebrates, multivariate analysis of our datasets showed that spatial patterns in catches were mapped equally well by both trap designs. This implies that variation in the effectiveness of small and large traps is relatively minor when compared to changes in the composition and abundance of zooplankton assemblages that occur at scales of tens of kilometers. Care will still be required, however, when comparing relative abundance estimates of taxa among sampling programs that have used different trap designs. Such comparisons must also consider the way in which traps are deployed. Baitfishes dominated catches in moored traps, while those of drifting traps were largely composed of reef fishes. Baitfishes were only abundant in drifting traps when traps were sampled near the bottom (Meekan et al., unpublished data). Moored traps also collected greater numbers of fish per hour of sampling than drifting traps. These differences may result from the deployment method, or alternatively might be due to the operation of traps in different environments. Drifting traps were used to sample stations on an offshore transect, while moored traps were anchored close to reefs. The relative influence of these factors could not be determined, as it was not possible to drift traps very close to reefs; this would have exposed the support vessel to danger and risked losing the trap in surf on the reef. Conversely, it was not possible to anchor traps in water depths that occurred along much of the transect.

In summary, our study shows that there were consistent differences in the abundances of catches of some fishes and invertebrates between small and large traps. Some of these might be rectified by simple design changes, such as shifting the position of entrances in small traps (Meekan et al. 2000) although, for other taxa, these differences probably result from behavioral responses to light and to being held within an enclosed volume of water. Our results will be useful for researchers who need to operate sampling programs with limited logistical support, as they suggest that small traps can map spatial and temporal patterns in the



abundance of late stage larvae of reef fishes and invertebrates as well as, or even better than, large designs.

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